USMC Small Unit Leader Non-Lethals Training System

Main Topic

A team of researchers and engineers in the Simulation and Systems Engineering Section at Southwest Research Institute (SwRI) is working on the second phase of a project for the United States Marine Corps that trains Marines in decision-making with respect to the use of non-lethal munitions in peacekeeping and crowd control operations. The Marines have several requirements for training their personnel for Military Operations Other Than War (MOOTW). In particular, SwRI is contracted to create a scenario-based, visual training system that gives Marines practice in making decisions under realistic conditions about the deployment and use of non-lethal munitions in a peacekeeping operation. The first phase of this project, called the Small Unit Leader's Non-lethals Trainer (SULNT), concluded with a successful test and demonstration at Camp Pendleton, California at the Emerald Express conference in April 1997. A follow-on project has been awarded to SwRI for additional tasks.

The SwRI team created a visual, scenario-based computer simulation that is highly interactive. The simulation includes models of the effects of specific non-lethal munitions in the Marine Corps arsenal and also of crowd and mob activities. Using the simulation, students are able to demonstrate their knowledge of proper rules of engagement, procedures for dealing with crowds and mobs, and their ability to make decisions about the appropriate level of force needed to control, contain, or disperse crowds and mobs. The Marine trainees can be confronted with several scenarios at once and by multiple crowds as large as 500 people each. Crowds move within a simulated urban environment along instructor-defined pathways and respond not only to actions taken by Marines but also respond autonomously to actions by other simulated crowds and to the passage of time. The trainees are able to deploy simulated barriers and fortifications and are constrained by realistic levels of ammunition, line of sight targeting, movement rates, and squad strength. The simulation uses both historical and generic ethnic, political and religious groups to confront the Marine trainees, and the confrontations take place within one of three different urban environments. The Marines are stationary for the most part and are in a reactive mode; however, they are free to move throughout the environment during the course of a training scenario.

The SULNT system is highly visual, with a Windows-like graphical user interface (GUI) and realistic 3D models of Marine personnel, checkpoint position defensive barriers, civilian crowds, urban areas, and surrounding countryside. The user interface also provides the trainee with textual descriptions of events, his orders and background information, rules of engagement (ROE), and controls for movement and interactive commands within the simulation. The trainee receives verbal feedback of scenario events and crowd actions/reactions from an electronic speech synthesizer and audio sound effects. The operational computer platform is a Silicon Graphics (SGI) Octane workstation with Maximum Impact graphics.

Prior to a training session, an instructor creates a new scenario for training (or edits an existing scenario) using a unique set of user interface displays and controls designed specifically for this purpose. A separate set of interface controls enables an expert user to alter some of the underlying simulation model control parameters such as munitions effects data. After the instructor has created a scenario, the trainee initializes his forces—a standard Marine rifle squad along with two designated marksmen—at a checkpoint location designated by his instructor. The trainee arms his simulated squad with lethal and non-lethal munitions that are part of the current Marine Corps arsenal. The effects of the munitions are modeled to first-order accuracy based on data provided to SwRI from the Naval Surface Warfare Center in Dahlgren, Virginia.

Training scenarios are run from a separate user interface screen, and during a scenario the trainee is faced with the activities of one or more simulated crowds. The crowds are modeled from data collected from experts, from scientific and technical literature, and from information gathered from Marine Corps and other government sources. The crowd model is dynamic and based on empirical knowledge gathered by experts. Each crowd is characterized by a series of attribute values which together comprise a crowd profile. Attributes include fanaticism, arousal state, prior experience with non-lethal munitions, and attitudes toward the Marines (fear, respect, anger, etc.), among others. The attribute profiles are linked to

a behavioral model that generates crowd activities during the course of a scenario such as demonstrations, carrying signs, throwing stones, and so on. The link comes through a set of Boolean relations shaped by our understanding of the literature and validated by our experts. Crowd movement is determined along initial paths defined by an instructor. However, actions taken by the trainee and other scenario events can influence crowd movement as well.

In a typical scenario, the trainee deploys his squad in fire teams, reserves, and designated marksmen. During the course of a scenario, he receives textual and audio information regarding crowd activities; and he can view a graphical display that shows either a 3D ground-level view or 2D overhead plan view of the modeled urban area. The 3D ground-level view provides the trainee with an accurate visual representation of the urban environment from any point on the ground, including buildings, streets, Marine personnel, checkpoint defenses, and civilian crowds. The trainee can also change his viewpoint to gain a better understanding of the situation at hand by moving freely about the environment in this view using a simple set of user interface controls. The 2D overhead plan view provides the trainee with a flat earth, god's-eye view from a static altitude above the urban area. In this view, the 3D models of people and defenses are replaced by 2D map symbols and movement within the scene is restricted to the four standard cardinal directions: north, east, south and west. Both graphical views are updated in real time as the scenario progresses, and the trainee can switch between either view at any time.

During a scenario the trainee can move his troops, issue verbal orders to the crowd, and order lethal or non-lethal fire. As in the real world, the supply of clips and ammunition is limited, there are line of sight and range restrictions, and munitions effects are probabilistic rather than absolute. The actions taken by the Marines affect crowd behavior in several ways. Some crowds can be dispersed by a simple verbal command, whereas other crowds disperse only with swift and heavy action from the Marines. The Marines can be affected by crowd behavior and activities as well. Squad units can suffer casualties from attacks by armed hostile crowds or by friendly fire from other squad units.

Each training run is independent and the outcome dependent on Marine actions and inaction. In other words, a trainee can run the same scenario several times and each run can result in a different outcome. Successful trainees read their background and orders, study their ROE, and make decisions based on proper procedures. At the conclusion of a successful run, the trainee receives a good report and other positive feedback. On the other hand, if rules are violated, the trainee is presented with verbal reports of bad outcomes such as an unacceptable number of civilian casualties, angry superior officers on their way to admonish the trainee, or a television news program reporting his actions in a negative manner.

The SULNT system also provides an after-action review capability that allows a trainee and his instructor to replay a scenario run in its entirety with all actions preserved. The replay can be paused, fast forwarded, or rewound to a specific time so that an instructor can make a teaching point. Scenario after-action reviews can also be saved for re-use in a group instructional setting.

Trainee options are based on USMC procedures and were validated by the Marine Corps experts including the project officer who leads the USMC non-lethals effort for the Marine Corps Warfighting Lab. This officer had direct personal experience with peacekeeping operations and non-lethal munitions in Somalia. In addition, SwRI gathered data while attending a Limited Objective Experiment (LOE) as an observer at Camp Pendleton in July 1996. The LOE was a three-week long field exercise in which Marines were trained in the use and tactics of non-lethals. Exercises with actors simulating crowds and mobs were conducted five to six times per day. In addition, Marine Corps Reservists who are active duty crowd control officers from the Los Angeles Police Department (LAPD) and the Los Angeles County Sheriff's Department (LASD) were also in attendance.

We believe that much of our success on this project is due to the detailed up-front analysis, the active participation of our sponsor and his experts, and the iterative testing of our software. In February 1997, the system was tested with enlisted personnel from the 15th Marine Expeditionary Force (Special Operations Capable) at Camp Pendleton. For one week, the system was put through its paces by the enlisted Marines (corporals and sergeants). The Marines used the system as students in the first half of the week and as instructors during the second half of the week. Their comments and suggestions for improvement were

collected by SwRI staff and many of their recommendations have been implemented. A second demonstration period took place at Camp Pendleton during April 1997, at the Emerald Express conference. During that conference, more than 30 military personnel and civilians used the system. In October 1997, the system was also demonstrated for the Platoon Leaders school at the Los Angeles County Sheriff's Department, and comments were collected and analyzed for improvements to the system. We are currently working in cooperation with the LASD on an internally funded research project at SwRI aimed at creating a law enforcement version of the system for use by civil authorities.

During development of this training system, SwRI researchers and engineers conducted structured interviews with experts from the uniformed services and from civil authorities in addition to the published literature. It is apparent to these researchers that there are many technical training and simulation issues and concerns which overlap between civil and military groups in confrontation with large groups of people, whether those groups are friendly, neutral or hostile, and whether the groups have peaceful or violent intentions. The type of crowd is also important. Crowds can be of several types including casual crowds of people who happen to be gathered in the same place (such as shoppers); expressive crowds who have gathered for specific behaviors such as worship, dancing, or singing; and aggressive crowds which are unorganized, potentially unlawful groups (Momboise, 1969). In addition to crowds, there are also mobs and rioters who are engaged in undesirable activities and may be out of control.

In recognition of the different types of crowds and mobs and, indeed, differences in the behavior of individuals within a single crowd, the SwRI group behavior model includes several psychological variables including level of aggression, hostility toward the Marines, prior experience with non-lethal munitions, and degree of fanaticism and devotion to ethnic, religious, or political causes. There are also parameters for the degree to which a crowd may be armed. The variables are set to an initial state by an instructor and change as the scenario unfolds. Actions taken by the Marines may make a crowd more or less angry, more or less hostile, and so on. If left alone and unchallenged by the Marines, the emotional variables may also change, depending on the initial states and the degree to which the crowds are hostile to one another.

Riots, mobs, and demonstrations are far more common than is realized by the general public and have been going on in all societies and in all parts of world since civilization began. As an example, in Constantinople in 532 A.D., a conflict between the "Blues" and the "Greens" erupted with over 30,000 casualties. The underlying cause of the rioting is thought to be political and economic, but the catalyst for violence was a chariot race (Steele, 1993). At present, law enforcement officers in major US cities may be involved in public confrontations on a weekly basis and damages can accumulate into the millions of dollars. These confrontations may be as small as a bar fight that spreads onto the street or as large as a celebration riot accompanying a major sports championship (Hillmann, 1991; McGregor and Griffiths, 1995). The National Law Enforcement Policy Center has called for special training in civil disturbances "for both line and supervisory officers, as well as command personnel." SwRI has also received informal inquiries from civil authorities and from other commercial companies about the possibility of re-use (or re-tooling) of the USMC-owned software for civilian purposes.

Currently, the SwRI team is providing hardware and software maintenance support for eight SULNT systems that are being used by fleet Marine forces in a one-year training effectiveness experiment conducted by the Marine Corps Warfighting Laboratory. We are also working in conjunction with the LASD in the analysis and requirements definition phase of our research project relating to a law enforcement training system based on the SULNT.

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Dr. Varner is a research psychologist responsible for identifying and researching new technologies, tools, and processes that will facilitate training. She has directed and participated in projects involving virtual environments, scientific data visualization, digital video, and speech recognition technologies in training. She developed a physics-based model and visual simulation of fire and smoke under SwRI's Internal Research and Development (IR&D) program. At present, she is project manager for the SULNT program and for an internal research project in cooperation with LA County.

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Mr. Royse is a specialist in electronic systems design, integration, and testing, and has significant design and project management experience in the development of simulation and multimedia-based training systems for the USMC, USAF, and NASA.

As manager of the Simulation and Systems Engineering Section, SwRI, Mr. Royse is responsible for the development of proposals and performance of project activities which involve engineering analysis, design, and development of training systems and simulation devices. He leads a group of engineers and computer scientists developing computer-based solutions to the training and simulation problems of government and industrial clients.

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Mr. Micheletti is experienced in the design, coding, testing and documentation of software for real-time, mission-critical avionics systems, avionics maintenance procedures training systems and simulators, and battlefield operations training systems and simulators.

Mr. Micheletti has been involved in the management, analysis, design, test, and documentation of software for several multi-station, networked training and simulation systems for the US Marine Corps and Air Force. He is currently the lead software developer on the SULNT project for the Marine Corps. The SULNT is designed to train decision-making skills for squad leaders regarding the use of non-lethal munitions in urban operations other than war.

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Major Eugene Apicella was assigned to his current duties as an Action Officer at the Marine Corps Warfighting Laboratory in September 1995. His duties include Non-lethal Capabilities Action Officer and Action Officer, Fires and Targeting Section, Marine Corps Warfighting Laboratory.

Most recently he served as Commanding Officer, Company K, Third Battalion, Seventh Marines, First Marine Division at the Marine Corps Air Ground Combat Center, Twentynine Palms, California from September 1992 through July 1995. While assigned to 3/7, he was also the Commanding Officer of Headquarters and Service Company and functioned at the Ground Combat Element Commander, Special MAGTF Belleau Wood during OPERATION UNITED SHIELD, the final U.N. withdrawal from Somalia. A 1992 Honor graduate of the U.S. Army Infantry Officer's Advanced Course, Major Apicella has also graduated from numerous other military specialty schools including the Airborne Course and Pathfinders Course.

Personal decorations include the Navy Commendation Medal, with two Gold Stars and Combat V, the Combat Action Ribbon, the Navy Achievement Medal, and the Armed Forces Expeditionary Medal.

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